ENVIRONMENTAL ASSESSMENT REPORT

CHEVRON U.S.A., INC.
CINCINNATI ASPHALT REFINERY
11001 Brower Road
North Bend, Ohio

JANUARY 1991

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ES JOB No. CL652.01

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1.0 EXECUTIVE SUMMARY

An environmental assessment concerning soil and groundwater quality was performed for Chevron U.S.A., Inc., (Chevron) by Engineering-Science (ES) at the Cincinnati Asphalt Refinery located at 11001 Brower Road in North Bend, Ohio. Site activities were conducted from 7 through 20 November 1990.

An ES geologist supervised the drilling and installation of 12 monitoring wells on site. Groundwater samples were collected from all 12 of the new wells and five existing wells. These samples were analyzed for volatile organic compounds, semi-volatile compounds, ammonia, and nitrate/nitrite. Duplicate samples and rinseate blanks were also collected and analyzed for these parameters.

Results of the site investigation are summarized as follows: analysis of volatile organic compounds in soil samples showed the presence of 5 μg/kg benzene in MW-6 and 5 μg/kg ethylbenzene and 18 μg/kg xylenes in MW-5, all of which are at or below current regulatory limits. Soil samples from MW-9 and MW-10 showed concentrations of trichloroethene (TCE) a suspected carcinogen, at 17 μg/kg and 31 μg/kg, respectively. These levels of TCE are also below current regulatory limits. Concentrations of acetone were detected at 120 μg/kg in MW-12 and 70 μg/kg in MW-15, and are below the regulatory limit for this compound.

Analysis of semi-volatile organic compounds in soil samples showed the presence of di-n-butyl phthalate in all samples except MW-14. This compound may be the result of laboratory contamination due to analytical procedures, since it was also found in many of the method blanks. Aside from this compound, semi-volatiles were only detected in soil from MW-6, -9, -11 and -14. Of the semi-volatiles detected, six of the compounds are either known or suspected carcinogens. There are currently no regulatory limits on semi-volatile compounds in soil.

Results of the soil pile analyses showed barium to be the only constituent detected in the TCLP analysis. Barium was detected at 1.05 mg/l, which is below the toxicity characteristic (TC) regulatory level of 100 mg/l. Flashpoint was determined to be 180°F.

Groundwater analytical results for volatiles and semi-volatiles showed the presence of volatiles in MW-10. Compounds detected were 1,2-dichloroethene (total) at 160 μg/l, TCE at 110 μg/l, and 1,1,1-trichloroethane at 3 μg/l. According to the EPA Maximum Contaminant Level (MCL) for these constituents, both the TCE and 1,2-dichloroethene concentrations are in excess of regulatory limits for drinking water. The semi-volatile compound bis(2-ethyl hexyl) phthalate was also detected in MW-4 and MW-11. ES believes that the presence of this compound is due to contamination by laboratory procedure.

Analysis of ammonia and nitrate/nitrite in the groundwater samples showed ammonia present in five wells, ranging in concentration from 0.3 mg/l in MW-6 to 16 mg/l in MW-2. There is currently no regulatory limit for ammonia in drinking water. Nitrate/nitrite was found in all wells sampled except MW-15, and ranged in concentration from 0.5 mg/l in MW-3 and -14 to 110 mg/l in MW-4. The MCL for nitrate/nitrite in drinking water is 10 mg/l, which indicates nine of the wells sampled contain nitrate/nitrite in excess of the regulatory limit. Results of these analyses show similar trends in the distribution of ammonia and nitrate/nitrite in the site groundwater. With the exception of an isolated high concentration of nitrate/nitrite in MW-4, it appears that the highest concentrations of these constituents exist in MW-2, and in general, occur in areas of the site directly adjacent to the Kaiser Chemical Company. Groundwater elevation data obtained by a previous consultant from 27 October 1989 to 26 September 1990 indicates that the Kaiser Chemical Company is located upgradient of the site during non-winter months.

2.0 INTRODUCTION

2.1 PROJECT UNDERSTANDING

The Cincinnati Asphalt Refinery located in North Bend, Ohio has reported the presence of ammonia and nitrates in its groundwater since 1979. Since the asphalt refinery relies on on-site water production to provide the plant water supply, Chevron U.S.A., Inc. (Chevron) has instituted several groundwater quality studies at the site to determine the concentration and extent of ammonia and nitrates within the groundwater. Data from these studies were then used to determine if any portion of the site could be used for water production, or if alternative off-site water supplies would be necessary.

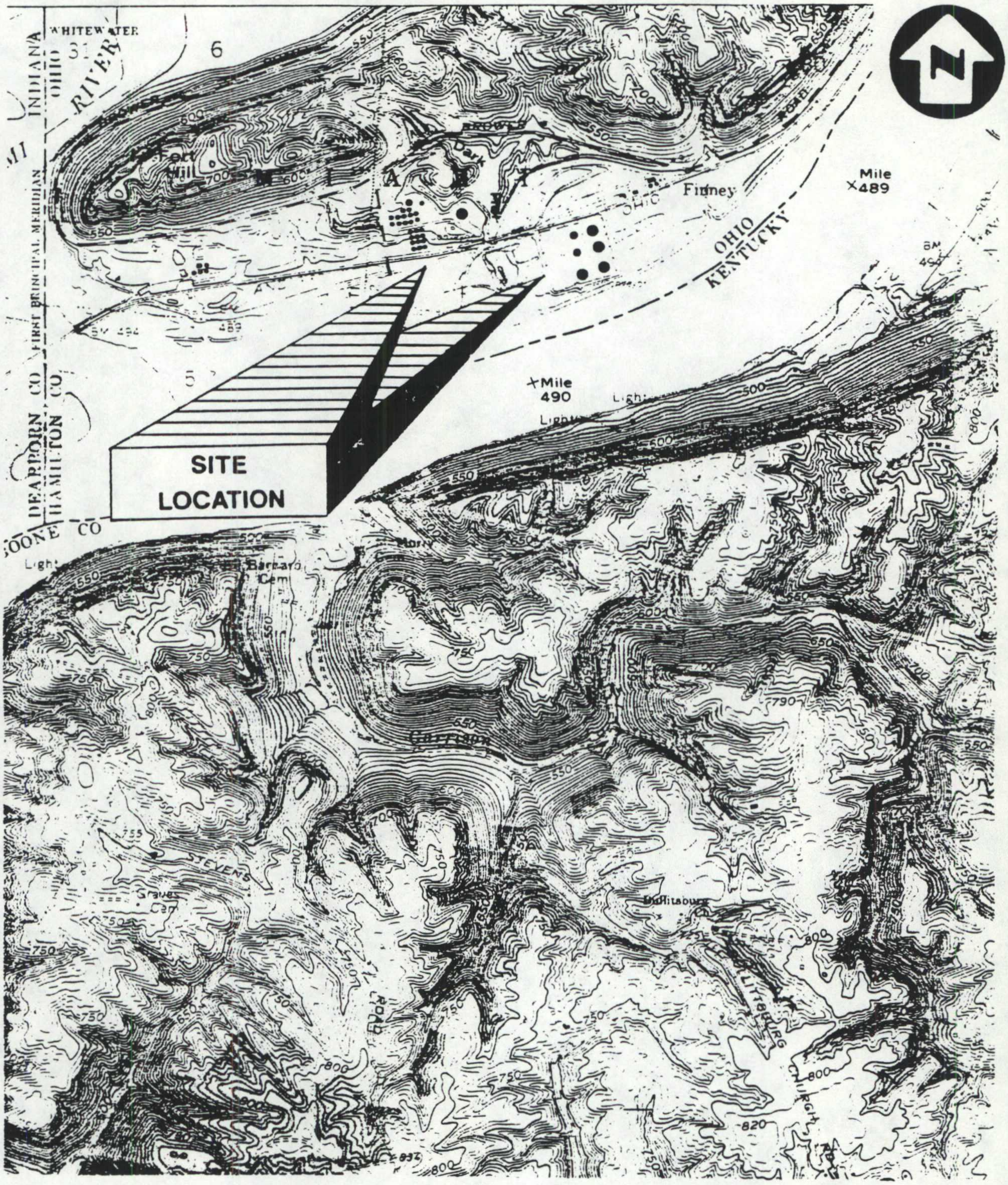
2.2 PURPOSE OF INVESTIGATION

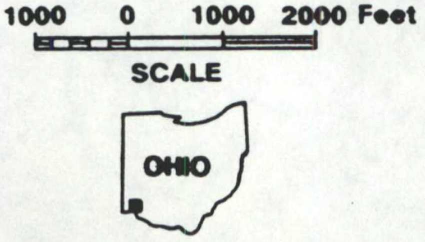
In recent months, Chevron has considered selling the asphalt refinery. For this reason, ES was contracted by Chevron to conduct a thorough soil and groundwater quality assessment at the site prior to any potential property transfer. The site assessment was performed from 7 through 20 November 1990. The purpose of the assessment was to obtain data on the quality of the soils and groundwater beneath the site. This was accomplished through the installation and sampling of 12 on-site monitoring wells for soils and groundwater, as well as the procurement of groundwater samples from six existing monitoring wells on site.

2.3 LOCATION AND PHYSIOGRAPHIC SETTING

The site is located at 11001 Brower Road in North Bend, Ohio, in the extreme southwestern corner of the State (Figure 1). It is situated on the northern bank of the Ohio River, approximately 0.9 miles east of the Indiana State line. The site is divided into a northern section and southern section by the Baltimore and Ohio Railroad that runs west-east through the center of the site. Brower Road borders the site on the north, and the Ohio River borders the site on the south. The western boundary of the refinery is its access road from Brower Road, and the eastern boundary is a wooded

FIGURE 1





QUADRANGLE LOCATION

SITE LOCATION MAP

CHEVRON U.S.A., INC.

CINCINNATI ASPHALT REFINERY

11001 BROWER ROAD

NORTH BEND, OHIO

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area. Topography in the vicinity of the site consists of the flat, low-lying Ohio River floodplain around the southern section, and moderately steep upward slopes to the north in the northern section. These slopes north of the railroad tracks may be stream terraces of the Ohio River. An intermittent stream flows southward through the center of the site.

3.0 BACKGROUND INFORMATION

The information contained within this section of the report is a brief synopsis of the background information provided in the report on this site by Geraghty and Miller Hydrocarbon Services, Inc. (GMHS), dated April 1989.

3.1 FACILITY DESCRIPTION AND HISTORY

The Cincinnati Asphalt Refinery has been in operation since 1954, and is involved in handling both raw materials and finished asphalt products. These products are stored in above-ground storage tanks (ASTs) located on site. In addition to these tanks, the refinery consists of several loading racks, a laboratory, first-aid station, maintenance shop, machinery and equipment storage areas, a main business and reception area, and three on-site groundwater production wells, of which two are currently in use. These wells produce groundwater at a pumping rate of approximately 250 to 300 gallons per minute (gpm). The water produced is used for cooling and steam generation, and in manufacturing processes at the refinery. The Baltimore and Ohio Railroad that runs through the site divides the site into a northern section that contains most of the buildings, facilities, and ASTs, and a southern section that contains a diked tank farm of six ASTs. A site plan is shown in Figure 2.

3.2 PREVIOUS INVESTIGATIONS

Since the detection of ammonia in the site groundwater prior to July 1979, five consultants have produced six reports on the groundwater quality and possible alternative water supply sources at the asphalt refinery. These studies included the installation of monitoring wells, measurement of water levels, analysis of water quality, and aquifer testing. The studies produced a monitoring well network of approximately 13 wells that was established at the site from 1979 to 1989 by three of the previous consultants. GMHS has reported that three of these wells are dry, and one other well cannot be located in the field. All of the wells have been drilled into unconsolidated materials to depths ranging from 16.5 feet to 119 feet. Groundwater sampled in the northern part of the site (wells west, south, east, and MW-2) exhibited high nitrate/nitrite, ammonia, sulfate, chloride, and sodium concentrations. Wells in the southern part of the site (MW-1, MW-3, T-WQ1, T-WQ2, T-WQ3, B-5 and B-7) exhibited low concentrations of the above-mentioned constituents. Recommendations from all five consultants included developing alternative water supply sources in the areas of the site directly adjacent to the Ohio River.

3.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

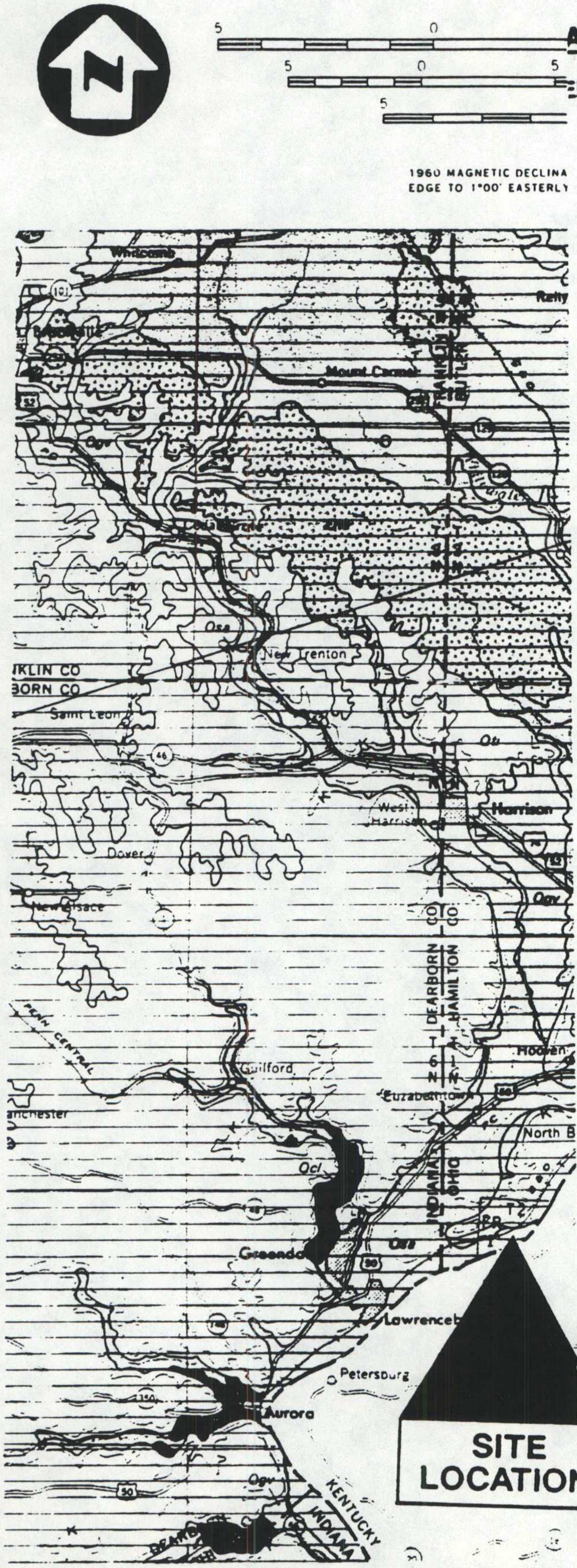
The geology within the vicinity of the site is characterized by a unit of alluvium approximately 0 to 100 feet thick, deposited by the Ohio River and/or its tributaries. The upper section of alluvium (from 0 to 50 feet below grade) consists of yellow-grey to brown clay, silt, sand, and gravel. The lower section of alluvium consists mainly of sand and gravel, with pebbles derived from nearby rocks. A geologic map of the North Bend area is shown in Figure 3.

The alluvium described above are collectively one of the best groundwater-producing aquifers in the Hamilton County area, and the only aquifer suitable for large industrial water supply demands. Well yields of 500 gpm or greater are common in this vicinity. On-site testing of the aquifer by Reynolds Supply, Inc., resulted in a transmissivity (T) value of approximately 170,000 gallons per day per foot (gpd/ft). GMHS performed aquifer tests that resulted in a T value of 40,000 gpd/ft. Reasons for this difference in values were not discussed in the GMHS report referenced at the beginning of this section.

3.4 GROUNDWATER FLOW DIRECTION AND ELEVATIONS

Groundwater flow directions and elevations were recorded by GMHS for approximately one year from 27 October 1989 to 26 September 1990. These data showed that groundwater flow direction changed throughout the coarse of the year from a southeast direction (toward the Ohio River) in October to a northwest direction in February, returning again to a southeast direction in June. The flow of groundwater to the northwest would seem unexpected and unlikely in this area, as surface elevations rise northward from the river, and rivers in general act as groundwater discharge areas. One possible explanation for the northwesterly flow of groundwater at this site in February

FIGURE 3



Illinoian

Qal

Silt, clay, and sand

Lacustrine deposits and washed till. Lacustrine facies of Atherton Formation in Indiana

Qti

Till

Includes some ice-contact stratified drift and, in Ohio, extensive areas of bedrock (see note). Jessup Formation in Indiana

Illinoian and older

Qsr

Silt, sand, and gravel

Mostly alluvium, but includes some colluvial and lacustrine deposits. Prospect Formation in Indiana

Kansan

Qtk

Bedrock with small areas of till

See note

Note: Available data are insufficient to show units Qti and Qtk in detail in Ohio

GEOLOGIC MAP OF THE NORTH BEND AREA

CHEVRON U.S.A., INC.

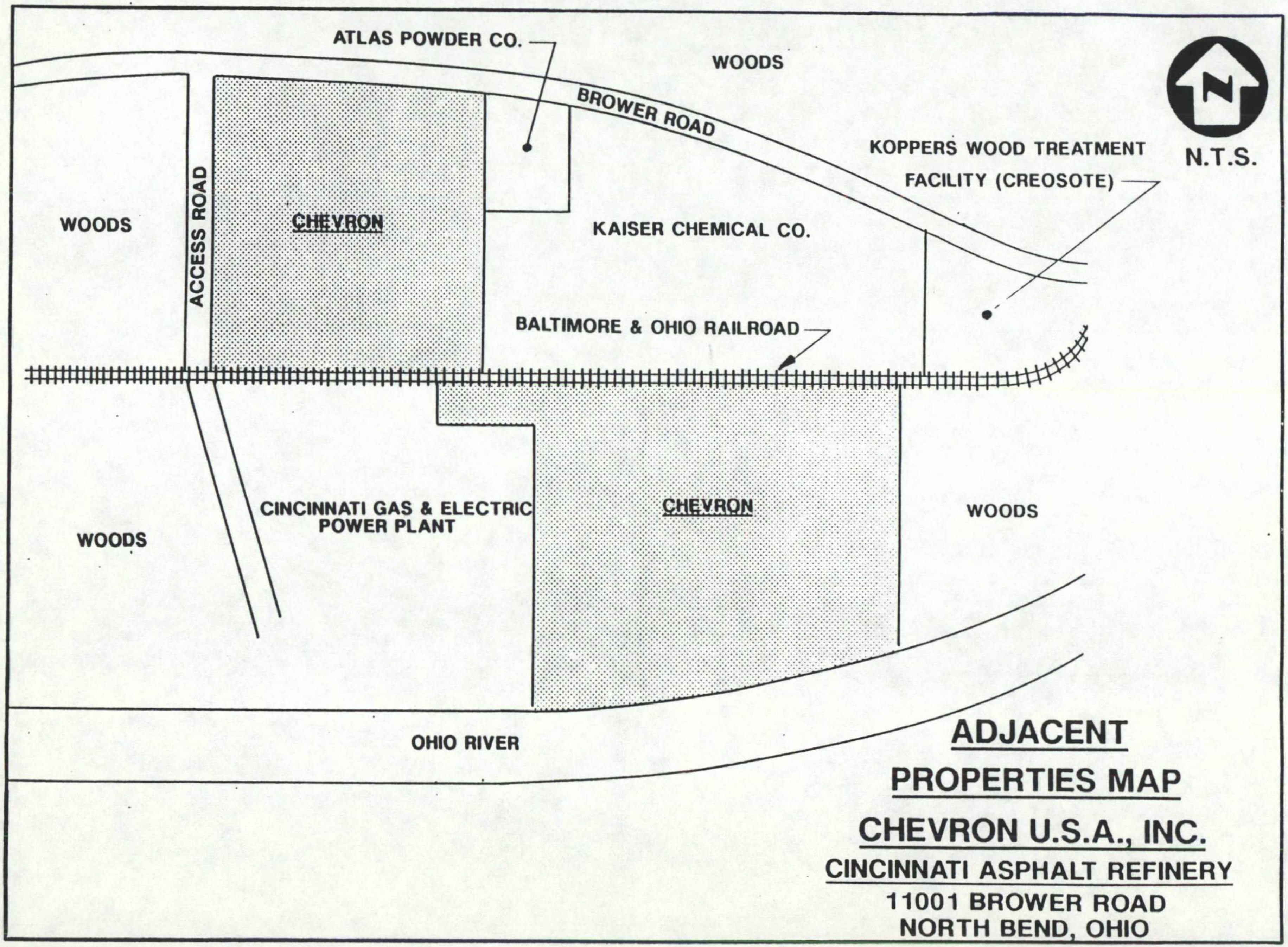
CINCINNATI ASPHALT REFINERY
11001 BROWER ROAD
NORTH BEND, OHIO

1990 is the allowance of a greater volume of water to flow through the locks on the Ohio River in winter to compensate for the decreased amount of navigable water available available due to winter freezing. Such a release of water on the Ohio River could be sufficient to raise groundwater levels on site near the river, as the river would act as a recharge source for the area. Consequently, this would produce a northwesterly groundwater flow. Further support of this hypothesis is evidenced by groundwater elevation measurements taken by GMHS during the above-mentioned one-year interval. These data showed that during the month of February, groundwater elevations were highest in MW-3 (southern section of the site) and lowest in B-4 (northern section of the site). These elevations indicated a groundwater flow direction to the northwest.

In addition, the groundwater elevations recorded in February were the highest readings recorded during the one-year interval. This lends credence to the possibility of greater volumes of water flowing in the river during winter and raising site groundwater elevations. During September, groundwater elevations were the lowest of all measurements taken during the year, and showed groundwater levels to be higher in the northern section of the site than in the southern section. These data illustrate the southeasterly groundwater flow direction in non-winter months mentioned earlier. It is possible that the groundwater production wells on site could have some affect on the direction of groundwater flow. Other data obtained by GMHS showed a yearly groundwater level fluctuation of approximately six feet in the northern part of the site, and 12 feet in the southern part of the site. This would appear to further support the idea that an increased volume of water in the Ohio River during winter months may be the cause of greater fluctuations in groundwater levels in the southern section of the site, which could cause changes in groundwater flow direction over the entire site.

3.5 LOCAL LAND USE AND ADJOINING PROPERTIES

Land use in the vicinity of the site is industrial. The Kaiser Chemical Company, an agri-chemical manufacturing facility, exists north of the southern section of the site, between Brower Road and the railroad tracks (Figure 4). The Atlas Powder Company resides immediately to the east of the northern site section, between the site and the Kaiser Chemical Company. The Cincinnati Gas and Electric (CG&E) Power Plant exists south of the northern section of the site, directly adjacent to the railroad tracks.



ADJACENT PROPERTIES MAP

CHEVRON U.S.A., INC.

CINCINNATI ASPHALT REFINERY

11001 BROWER ROAD
NORTH BEND, OHIO

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FIGURE 4

Koppers Wood Treatment facility, which used and/or produced creosote, formerly existed off the northeast corner of the southern site section, but is not in existence today.

3.6 ADJACENT PETROLEUM FACILITIES

Engineering-Science is not aware of any petroleum facilities currently or formerly in operation near this site.

3.7 LOCAL WATER RESOURCES AND SOURCES OF SUPPLIES

Local residences in the Miami Fort area and the town of North Bend are supplied with water from private wells and cisterns. It is likely that most of the water obtained from these sources is not treated prior to consumption The town of Cleves is supplied with water from wells located in the Great Miami River aquifer. Water obtained from this aquifer is treated before consumption. The asphalt refinery and other businesses in the area obtain drinking water from Cleves in monthly truckload supplies.

The Ohio Department of Natural Resources (ODNR) has identified 25 local water wells within a one-half mile radius of the site. Well logs for these wells and a map showing their locations are presented in Appendix A.

4.0 INVESTIGATION METHODS

4.1 SOIL SAMPLING AND ANALYSIS

Twelve soil borings were drilled on site by Belasco Drilling under ES supervision from 7 through 17 November 1990. The borings were advanced with 6.25-inch inside diameter (ID), hollow-stem augers. Soil samples were collected from each boring at five-foot intervals with a two-foot, split-spoon sampler. Soil descriptions for each soil sample were logged and recorded by the ES geologist. Each sample was also examined for odor and visual evidence of hydrocarbon staining.

Each split-spoon sample was divided in half and one portion scanned for the presence of volatile organic compounds (VOCs) with a Photovac TIP II photoionization detector (PID). In this test, half of each split-spoon sample was placed in a clean, air-tight jar. The mouth of the jar was covered with aluminum foil, then secured with an air-tight lid. After a minimum of 15 minutes, the headspace gas above the sample was scanned for VOCs with the PID by piercing the aluminum foil seal with the instrument probe, and recording the maximum VOC concentration observed. The other half of the split-spoon sample was placed in a 50 ml soil sample jar fitted with a Teflon-lined lid and saved for laboratory analysis. The sample from each boring with the highest VOC concentration was submitted to Wadsworth/ALERT Laboratories, Inc., for analysis of volatile organic compounds (Method 8240) and semi-volatile compounds (Method 8270).

All soil cuttings produced from the borings during drilling were stored in one area on plastic sheeting. The location of this soil pile is shown in Figure 2. One soil sample was collected from the soil pile after all borings had been drilled, and the sample was analyzed for flashpoint (Method 1020) and TCLP (volatile and semi-volatile organic compounds, RCRA metals, herbicides, and pesticides) for use in future disposal of the soil at a local landfill.

4.2 MONITORING WELL CONSTRUCTION

All 12 borings were completed as monitoring wells. Locations of these wells are shown in Figure 2. All of the wells were located based on information concerning previous spills on site and apparent visual staining of surface soils as observed by ES personnel at an earlier on-site meeting with Chevron. The depth of each well and the amount of screen used in each was determined prior to installation based on existing groundwater elevation data. The wells were set so that the screens extended 7 to 13 feet below the top of the water table and 3 to 13 feet above the water table to allow for seasonal fluctuations in groundwater elevation. These specifications were tailored to each well location to fit the conditions observed in the field during installation. The monitoring wells were set at depths between 23 and 55 feet below grade. All wells were constructed with four-inch ID, 0.010-inch slotted PVC screen, and four-inch ID, PVC riser. The bottom of each well screen was fitted with a PVC plug. A medium-grained sand pack was placed in the annular space around the screen, extending two to three feet above the top of the screen. A bentonite seal of one to two feet was placed above the sand pack and the remaining annular space was filled with grout to one foot below grade. Three of the wells, MW-12, -13 and -14, were completed with above-grade metal protective casings set in concrete. All other wells were completed with flush-mounted manhole covers set in concrete. Each well was secured with a locking monitor-well cap and a master lock as specified by Chevron. Monitoring well logs are presented in Appendix B.

All wells were fixed with an identification plate made of stainless steel with the well number etched on its surface. The plates were bolted to the top of each manhole cover or above-grade protective casing for future identification of the wells. All wells were professionally surveyed for vertical and horizontal control by Tri-City Engineering Company.

Quality assurance/quality control (QA/QC) was maintained in the field by thorough decontamination of all equipment and materials that contacted the boring during drilling. All split-spoons were decontaminated by washing in a Liquinox solution and rinsing in tap water between uses. Split-spoons were allowed to air-dry. All augers and other drilling equipment were steam-cleaned after use at each well.

4.3 GROUNDWATER SAMPLING AND ANALYSIS

On 11 November 1990, ES personnel began sampling five existing monitoring wells and the new monitoring wells at the site. The five existing wells sampled were MW-1, -

2, -3, B-4 and B-7. Only these were sampled because the screened interval in the T-WQ wells is unknown, and the other "B" series wells were dry. Static water levels were taken in all wells with an electronic depth meter prior to purging. The groundwater level measurements were not all taken on the same day. These levels are presented in Table 1.

New monitoring wells were developed by "surging" with a PVC bailer while removing three casing volumes of water. The wells were then allowed to equilibrate for 48 hours prior to purging. Purging of both the new and existing wells was completed using a PVC bailer and polypropylene rope to remove three casing volumes of water, or bail the well dry. During sampling, care was taken to minimize agitation of the sample. Each sample was decanted directly from the top of the bailer into the appropriate sample container, and the proper preservative was added. All wells were sampled for analysis of volatile organic compounds (Method 8240), semi-volatile compounds (Method 8270), ammonia (Method 350.2) and nitrate/nitrite (Method 353.2).

Duplicate groundwater samples were taken from MW-3 (Duplicate #1) and MW-13 (Duplicate #2) to evaluate the repeatability of samples obtained in the field. These samples were analyzed for the same parameters discussed above. Trip blanks were issued by the laboratory and placed in each of the coolers used to store samples during collection and shipping. These blanks were analyzed by Method 8240. Rinseate blanks were also obtained from bailers after decontamination procedures during each day of sampling, and analyzed for all the parameters discussed above. All blanks were analyzed to evaluate the quality and consistency of field decontamination procedures and potential external sources of contamination.

All equipment and materials that contacted the wells during sampling were decontaminated in the field. All bailers were decontaminated between purging and sampling each well by washing with a Liquinox solution, rinsing with tap water, rinsing with distilled water, and rinsing with methanol. All equipment was allowed to air dry. New polypropylene rope was used at each well for bailing and sampling.

TABLE 1

GROUNDWATER ELEVATION DATA

CHEVRON U.S.A., INC.
CINCINNATI ASPHALT REFINERY
North Bend, Ohio

Well	Date	Well Elevation(1) (ft)	Depth to Water (ft)	Water Elevation (ft)
Existing Wells				
MW-1	--	483.03	--	--
MW-2	13 November	477.34	21.25	456.09
MW-3	12 November	479.40	22.68	456.72
B-4	13 November	504.39	46.65	457.74
B-5	12 November	482.31	Dry	--
B-7	14 November	479.27	22.37	456.90
New Wells				
MW-4	19 November	496.06	41.54	454.52
MW-5	19 November	496.24	41.61	454.63
MW-6	19 November	496.17	41.51	454.66
MW-7	15 November	499.71	44.97	454.74
MW-8	15 November	500.12	45.40	454.72
MW-9	19 November	501.19	46.50	454.69
MW-10	19 November	508.95	54.19	454.76
MW-11	19 November	491.96	37.06	454.90
MW-12	15 November	479.42	24.08	455.34
MW-13	14 November	481.81	25.92	455.89
MW-14	14 November	478.24	22.24	456.00
MW-15	14 November	471.93	15.46	456.47

(1)Elevations surveyed from top of casing.

-- Data not obtained.

5.0 HYDROGEOLOGIC ASSESSMENT

5.1 GEOLOGY

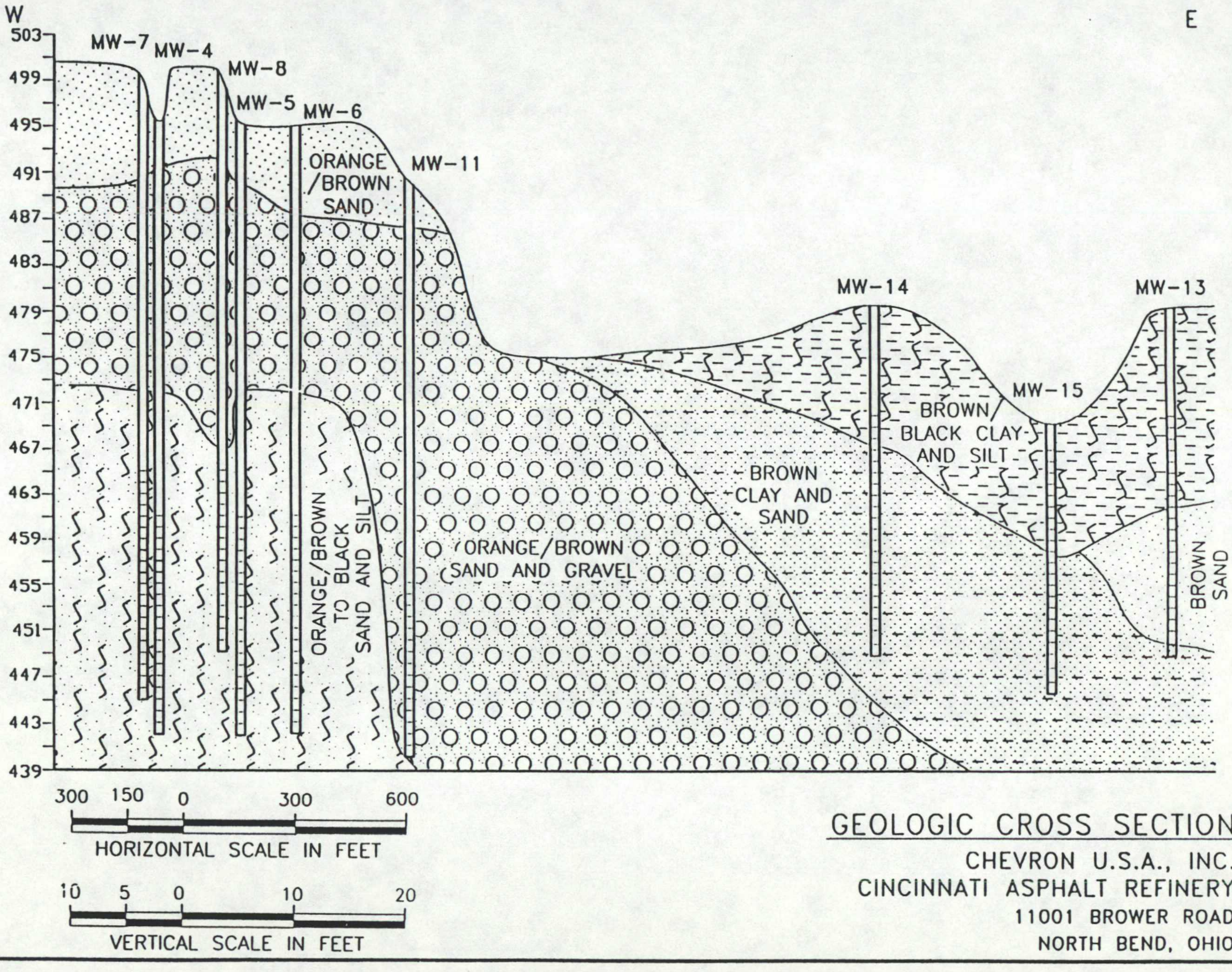
The southern section of the site in which MW-13, -14 and -15 are located is characterized generally by clays, silt and sand. Dry, brown to green/black clay and silt were encountered in all three wells from three to ten feet below grade. Clay and very fine sand were encountered at approximately 14 feet in each well, and these sediments contained varying amounts of fine to medium gravel at depths below 14 feet. Small, black, angular fragments of what may be asphalt were observed in the soils between three and 15 feet below grade.

The northern section of the site is comprised mainly of brown/orange-brown to black and white sand, silt, and gravel, with minor amounts of clay in the upper five feet in some locations. Sands and gravels are the predominant sediments, ranging in grain size from very fine to very coarse. Fill material composed of slabs of sandstone and concrete approximately three to four inches thick were encountered along the railroad tracks in MW-4, -5 and -6.

The sediments found throughout the entire site exhibit distinct fining-upward sequences, suggesting they are fluvial. Bedrock was never encountered in any of the wells. A geologic cross-section of the site is presented in Figure 5.

5.2 HYDROGEOLOGY

Groundwater was encountered in all wells installed at the site. In the southern section of the site, groundwater was encountered between 13 and 20 feet below grade. In the northern section of the site, groundwater was encountered between 38 and 48 feet below grade. A groundwater elevation map for the site is presented in Figure 6. This map shows that groundwater flows to the north in the southern section of the site, and flows southwest and northeast from B-4 in the northern section of the site. These flow patterns may be the result of a transitional stage between the northwesterly winter groundwater flow pattern and southeasterly spring/summer flow pattern suggested by GMHS, and discussed in an earlier section of this report. The overall difference in groundwater elevation across the site was approximately two feet. Groundwater was



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GEOLOGIC CROSS SECTION

CHEVRON U.S.A., INC.
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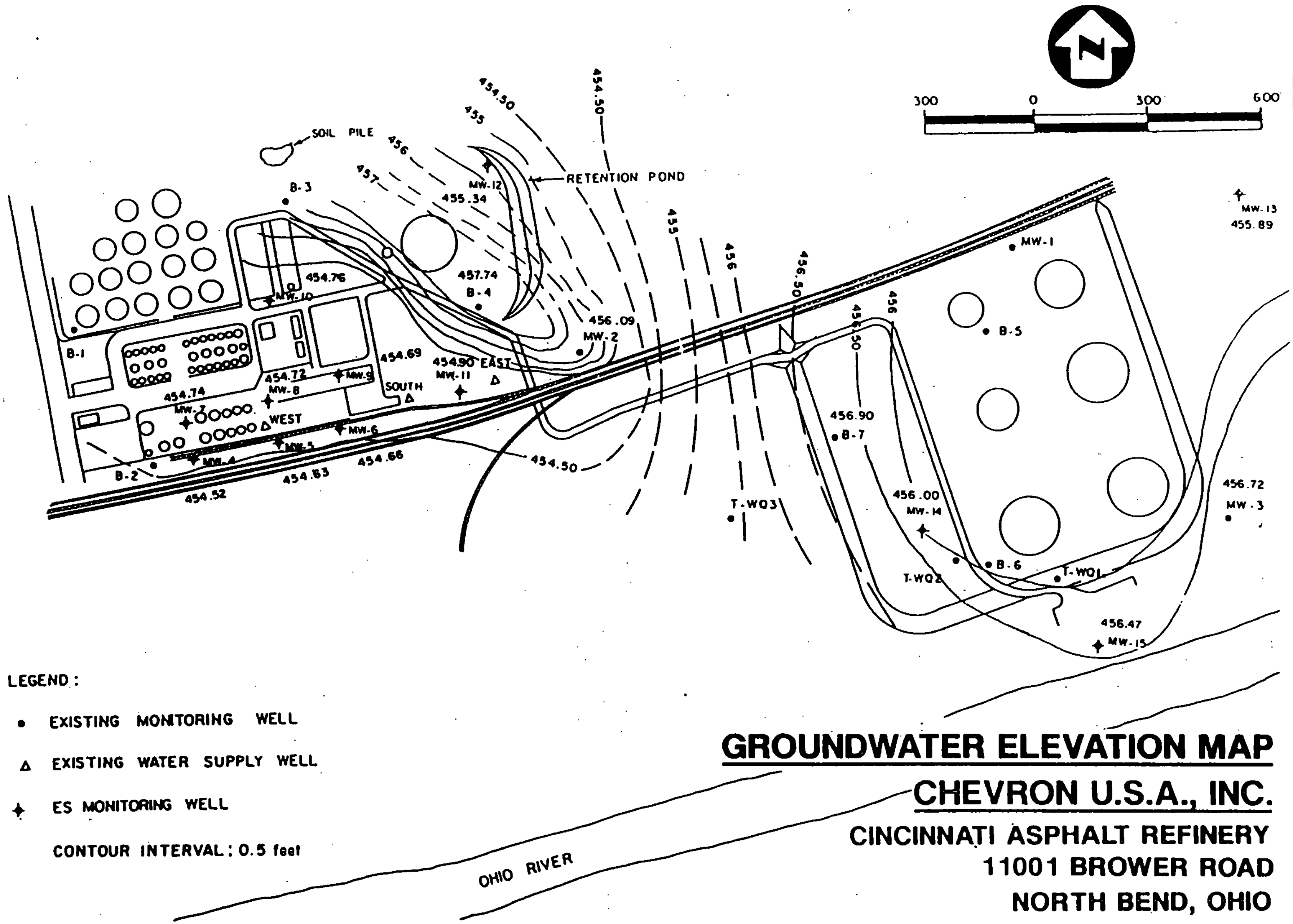
FIGURE 5



LEGEND:

- EXISTING MONITORING WELL
- Δ EXISTING WATER SUPPLY WELL
- ✦ ES MONITORING WELL

CONTOUR INTERVAL: 0.5 feet

GROUNDWATER ELEVATION MAP

CHEVRON U.S.A., INC.

CINCINNATI ASPHALT REFINERY
11001 BROWER ROAD
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FIGURE 6

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6.0 TECHNICAL SUMMARY

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An ES geologist supervised the drilling and installation of 12 monitoring wells on site. Soil samples were collected and a volatile organic compound (VOC) headspace analysis was performed on each sample. The sample with the highest VOC concentration from each well was submitted for laboratory analysis of volatile organic compounds (Method 8240) and semi-volatile compounds (Method 8270). Soil samples were logged and the absence of phase-separated hydrocarbons (PSH) was recorded. Soil cuttings produced during the drilling of each well were stored in one location and analyzed for flashpoint (Method 1020) and TCLP (volatile and semi-volatile organic compounds, RCRA metals, herbicides, and pesticides) for use in future disposal of the soil at a local landfill.

Groundwater samples were collected from all 12 of the new wells and five existing wells. These samples were analyzed for volatile organic compounds (Method 8240), semi-volatile compounds (Method 8270), ammonia (Method 350.2), and nitrate/nitrite (Method 353.2). Duplicate samples and rinseate blanks were also collected and analyzed for these parameters.

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APPENDIX A